ERCB

Harvest Operations Corporation Suspended Well Release 07-11-015-09W4M September 8, 2008

ERCB Investigation Report

June 18, 2009

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Energy Resources Conservation Board

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Contents

1 Incident Overview 1
1.1 Well History 2
2 Significant Findings 3
2.1 Harvest Investigation 3
2.2 ERCB Investigation 4
3 Actions Taken to Prevent Recurrence 4
3.1 By Harvest 4
3.2 By the ERCB 5
4 ERCB-Directed Actions 5
5 ERCB Follow-up 5

1 Incident Overview

On September 8, 2008, at 11:20 a.m. Harvest Operations Corporation (Harvest) was notified by a survey crew that a surface crude oil spill had been discovered on the Canadian Forces Base Suffield (Suffield Base) at location Legal Subdivision 7, Section 11, Township 15, Range 9, West of the 4th Meridian.

At 12:30 p.m., Harvest staff responded to the suspected spill and found that heavy oil was intermittently flowing out of a well casing and that no wellhead had been installed. Upon confirmation of the release, Harvest activated its corporate emergency response plan (CERP).

The crude oil spill extended from the well casing about 165 metres (m) south and east along the ground following pre-existing wildlife trails and created small pools in lower areas and natural depressions.

At 1:10 p.m., the ERCB Medicine Hat Field Centre (MHFC) and the Suffield Industry Range Control (SIRC) were notified of the release. Harvest began to mobilize equipment for containment and cleanup and to develop plans to isolate the well.

An area of about 1200 square metres was impacted, and it was discovered that birds were attracted by the surface crude oil spill. It was estimated that there were about 200 dead birds in the pooled oil, consisting mainly of sparrows with a few larger birds, such as ducks.

Harvest notified Alberta Sustainable Resource Development (SRD) (Fish and Wildlife) of the incident at about 2:00 p.m. and also contacted Athene Environmental (Athene) requesting that a wildlife biologist be dispatched to the site. Summit Liability Solutions (Summit) was contacted to begin spill cleanup the next morning, and Harvest began to mobilize equipment to the site.

At 3:30 p.m., representatives of the Suffield Base Range Sustainability Section (RSS) arrived on site to assess the incident, and under its direction Harvest personnel began putting oily dead birds into plastic garbage bags. There was no final count done of the dead birds. Vacuum trucks arrived and began to suck up oil around the wellhead, and a hose was installed about 5 m into the well casing. At this time, the well stopped flowing oil outside of the casing.

At about 4:15 p.m., SRD staff arrived on scene, and at 5:00 p.m. the Suffield Base commander was notified of the incident by Harvest. Incident notification had already been supplied by SIRC to the Suffield Base commander.

At 5:30 p.m., Lonkar Wireline arrived on location to install a WR plug, and at 6:00 p.m. the senior wildlife technologist with Athene arrived on site to monitor and assess wildlife affected by the spill, complete a reconnaissance of the area around the spill, and ensure that no other wildlife or habitat was impacted. Additional information relating to the impact on wildlife was communicated to the MHFC, and an inspector was dispatched to the release site.

At 6:50 p.m., installation of a retrievable WR plug into the wellbore was completed, well control was achieved, and the MHFC inspector arrived on scene.

On September 9, 2008, the surface casing bowl was removed and a wellhead was installed and its valves were closed.

To prevent wildlife from landing on the spilled hydrocarbons, controls were implemented before equipment arrival, which included placing plastic poly sheets on new oil pools and calling in Harvest personnel to distract wildlife from the spill area. Three backhoes arrived on site at about 11:00 a.m. and were used to consolidate the surface-impacted soils and any free product and to ensure that no other wildlife would be affected.

A temporary poly-lined containment cell was constructed on the adjacent producing Harvest well pad to store impacted soils excavated from the spill area until receipt of landfill approval (a sample of the waste material was sent for analysis to ensure that it met landfill criteria).

At about 12:00 p.m., a wildlife survey was conducted within 1000 m of the spill to determine potentially affected wildlife in the area. The survey focused on species that have been identified as of concern by provincial or federal government agencies under various acts and regulations, as well as their habitats.

No key wildlife areas, as established by SRD for "Sensitive" or "At Risk" species, were observed within 1000 m of the spill and no oiled species of concern were found during the survey.

On September 10, equipment could not be mobilized to the site because overnight rainfall resulted in limited access and increased the susceptibility of the native prairie to rutting. Large silage tarps were used to cover all consolidated piles to protect against potential water runon and runoff. No hydrocarbon leaching from the impacted soil piles was identified prior to the placement of the tarps. The site was monitored throughout the day to ensure that no leaching occurred. On September 11, site conditions were still not favorable for heavy equipment, and site monitoring was continued.

On September 12, the impacted soils were loaded and transported to the poly-lined temporary containment cell on the adjacent producing Harvest well pad. Soil samples were obtained to confirm that the impacted area was free of any contaminants from the spill.

From September 17 to 20, about 1600 tonnes of impacted soil were removed, including a second lift after confirmatory samples proved additional impacted soils required removal. The impacted soils were sent to an approved waste management facility at CCS Newell.

On September 20, after additional sampling proved that the impacted area was free of any contaminants, Summit Liability Solutions began environmental remediation and the site was reclaimed. The site will be seeded with a seed mixture approved for the Suffield Base.

The incident was classified as a level-1 emergency by the ERCB and occurred on a restricted area of the Suffield Base. The incident received media attention, and a press release was issued by the ERCB Communications Group that the incident would be investigated.

1.1 Well History

Harvest has been operating on the Suffield Base since August 2004 when it acquired assets from EnCana Corporation. The Alderson Field, as Harvest refers to the area where the incident occurred, consists of five horizontal wells. There is also one saltwater disposal well operated by EnCana in the proximity of the horizontal wells.

In the Suffield Block, which includes the Alderson Field, there have been no reported incidents of a similar nature (i.e., downhole problem resulting in surface spill).

On December 5, 2005, Harvest began drilling a horizontal well and determined after the well's completion that the reservoir quality was poor. Harvest decided that given the reservoir quality and the standoff from the oil-water contact, the well would not be economical based on its economic criteria in 2005. Consequently, Harvest chose to set abandonment plugs with an HAP bridge plug into the well hole and to circulate about 150 linear metres of class "G" cement on top of the plug. The work was completed on December 14, 2005.

Harvest then decided that the well could be used for pressure support in the area, and therefore, it would not cut and cap the casing. The decision not to abandon but to leave the well as a possible pressure support well was presented to SIRC at its 2006 annual meeting.

2 Significant Findings

2.1 Harvest Investigation

The primary cause of the uncontrolled surface release of hydrocarbons was a failure to suspend the well in accordance with ERCB directives in combination with the following:

- A wellhead had not been installed on the well.
- The cement plug circulated into the hole by the drilling rig had accidentally circulated out of the hole, and the cement that remained in the hole formed an insufficient plug to hold back oil.
- The bridge plug installed in the well by the drilling rig leaked, allowing wellbore fluids to flow past it.
- The reservoir pressure in the Glauconite Formation had increased due to injection into the reservoir to a point where heavy oil began to flow to surface.

  The flow consisted of about 7 to 9 cubic metres (m^3) of reservoir fluid, of which 90 per cent was 13° American Petroleum Institute (API) heavy oil and 10 per cent was salt water. It is highly unusual for a well in the Sufficld area to have enough reservoir pressure to flow 13° API oil to surface.

  An injector well operated by EnCana is the offset operating well in Harvest's Alderson Field. To date, EnCana's well has injected about 156 700 m^3 of water into the Glauconite Formation. At the time the Harvest well was drilled, about 109 000 m^3 of water had been injected into the Glauconite Formation. This injection of water would have provided some pressure support and may have been the pressure support that allowed the heavy oil to flow to surface.

  Harvest also operates water injector wells to the north of the Alderson Field. These wells may also have been a pressure source and, if so, may have contributed to the elevated pressure in the Alderson Field.

The public was never at risk from this incident.

Wildlife and the environment were adversely affected from the hydrocarbons on the lease.

The response to the incident was in compliance with the CERP but Harvest identified areas for improvement:

- Incident commanders should be within cellphone contact at any time during an incident.

- ERP roles and responsibilities should be quickly established and formally documented at the start of an incident.
- Communication and sharing of information with government agencies, regulatory bodies, and local authorities should be more efficient.
- The Calgary Emergency Operations Centre (EOC) should be formally established and members of the Calgary Emergency Response Team should be contacted and required to attend the EOC.
- Wall charts and guides for documentation purposes should be used to greater effect.

2.2 ERCB Investigation

The ERCB has fully reviewed Harvest's evaluation of the incident and explanation of the nature and circumstances of the release. The ERCB is satisfied with the evaluation that the primary cause of the release was a result of failure to suspend a well in accordance with ERCB directives.

The ERCB has determined that there were contraventions of its regulatory requirements related to the cause.

The ERCB has identified no contraventions of its regulatory requirements related to the subsequent response or the environmental remediation.

The ERCB reviewed documentation supplied by Harvest indicating that notification of well status was communicated to the Suffield Environmental Advisory Committee and SIRC in the fall of 2006, not to the ERCB Digital Data Submission system as required.

All required agencies and responsible parties were contacted (ERCB, Environment Canada, SRD, Alberta Environment, Alberta Environment Support & Emergency Response Team, SIRC, Suffield Base commander).

Harvest had an appropriate response to the incident and used all necessary resources.

Harvest maintained communication with and provided updates to all parties throughout the incident.

3 Actions Taken to Prevent Recurrence

3.1 By Harvest

Harvest has committed to the following:

- Bridge plugs that use mechanical force to set will not be used in cased horizontal wells past the kickoff point.
- Cement plugs set by drilling rigs will be balanced plugs that do not rely on density differences for the cement to settle on abandonment bridge plugs.
- Cement plugs circulated into the well will be "felt" by drill pipe or tubing to ensure that the plugs meet the requirements of *Directive 020: Well Abandonment Guide*.

- An extensive search of the company's properties will be conducted, both electronically and through Harvest's operations field staff, to ensure that there are no other suspended wells that may have open horizontal sections without wellheads.
- A review of all horizontal wells listed as abandoned on the public database will be conducted to ensure that the wells meet the abandonment requirements in accordance with *Directive 020* and/or are suspended properly in accordance with *Directive 013: Suspension Requirements for Wells*.

Harvest has also committed to share its knowledge relating to the incident with other operators, including all Sufficld Base industry operators, SEAC, SIRC and RSS. Harvest will notify the MHFC on completion of its commitment to share the knowledge gained from this incident with all Sufficld Base operators.

3.2 By the ERCB

The MHFC will continue working with Harvest on an ongoing basis and will confirm with Harvest the procedures and requirements for notifications of well status.

4 ERCB-Directed Actions

High Risk Enforcement Action 1 was issued on September 15, 2008, for not suspending a well in accordance with *Directive 013* requirements.

On October 29, 2008, Harvest successfully addressed the requirements from the High Risk Enforcement Action 1.

The ERCB directs that Harvest provide an overview of the incident to the appropriate Canadian Association of Petroleum Producers committee so that its experiences are shared with industry peers.

5 ERCB Follow-up

MHFC will follow up with Harvest on the completion of the ERCB-directed action.

MHFC will follow up with Harvest on the completion of the search for suspended and abandoned wells that may not be compliant with ERCB requirements.

The MHFC will contact all Sufficld Base operators with similar circumstances to request that they check their suspended wells to ensure compliance with ERCB requirements.